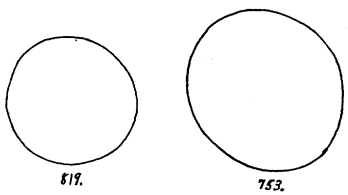
PROBABLE DIMORPHISM OF THE EGGS OF AN ARANEAD.[1]

THOS. H. MONTGOMERY, JR.

On comparing the eggs from cocoons raised in captivity of the common spider, *Theridium tepidariorum*, C. K.,[2] I was struck by the fact that eggs of the same age but from different cocoons may be of distinctly different volumes. That is to say, all the eggs of one cocoon may be larger or smaller than all the eggs of another cocoon made by the same spider.

In this comparison only such egg batches were considered, of which I had records as to the exact hour of oviposition. Further, comparisons were made only of eggs preserved by the same fixative, hardened in the same way, and preserved in the same grade of alcohol; in all cases the cocoons were opened and the eggs dropped into the fixative. Then all the spiders came from one locality, and all lived under the same conditions of captivity in the month of August, 1906.

The following cases exhibited different volumes of the eggs of successive cocoons made by particular spider individuals:



1. One spider formed three successive cocoons, nos. 752 (9th August), 818 (14th August), and 872 (19th August). Every egg of no. 752 (fixed at the age of twelve hours) was markedly larger than any egg of no. 818 (fixed at the age of fifteen hours) and no. 872 (fixed at the age of nineteen hours). The difference in these egg sizes is shown in the accompanying figures.

[1] Contributions from the Zoölogical Laboratory of the University of Texas, no. 81.

[2] *Vide* my preceding paper in this journal, "The Oviposition, Cocooning and Hatching of an Aranead, Theridium tepidariorum, C. Koch."

2. Another spider made two cocoons, nos. 725 (8th August) and 821 (15th August). All the eggs of no. 725 (fixed at the age of two hours and twenty minutes) were markedly larger than any of the eggs of no. 821 (fixed at the moment of oviposition).

3. Another spider made cocoons nos. 770 (11th August) and 905 (18th August); the eggs of no. 770 (fixed at the age of 50 minutes) were all markedly smaller than the eggs of no. 904 (fixed at the age of 60¼ hours).

4. A fourth spider furnished cocoons no. 726 (8th August) and no. 850 (17th August). The eggs of no. 726 (fixed at the age of 3½ hours) were all markedly smaller than those of no. 850 (fixed at the age of 3 hours).

The preceding series of cases show that successive cocoons may have eggs of the same size; or, and this is what more particularly interests us, that all the eggs of one may be larger or smaller than all the eggs of another. It will be also noticed (cases 1 and 4) that eggs of younger age may be larger than eggs of maturer age. Indeed, there is probably no change in the volume of a given egg from the time of oviposition up at least to the time of appearance of the limbs; accordingly, individual growth of an egg is not a factor entering in to disturb our conclusions as to these voluminal differences, since we are considering only stages antecedent to the appearance of limbs.[1]

To estimate the comparative egg volumina I placed the eggs side by side under the lens, and judged their difference ocularly, always comparing the smallest of a larger batch with the largest of a smaller batch. It would not be possible to estimate relative volumes by determining the number required to fill a given space, without first dissecting off the envelopes of each egg.

Now the variability of volume is usually of small amount in any given cocoon, that is, all the eggs of a cocoon are large or all small in most instances. But there are frequent exceptions to this. Thus one female produced three cocoons: nos. 722 (8th August), 800 (12th August) and 856 (17th August), all the eggs of no. 856 (fixed at the age of 26 hours) and

[1] During oviposition the eggs are polygonal, but usually within a few minutes all become rounded (slightly ovoidal), as has been noted by Balbiani: Mémoires sur le développement des Aranéides, 1873. *Bibl. de l'École des Hautes Études*, T. 7.

almost all the eggs of no. 800 (fixed at the same age) were larger than the eggs of no. 722 (fixed at the age of 1¾ hours), but a few eggs of no. 800 were as small as the eggs of no. 722. The same held for the successive cocoons of four other spiders. Then in one cocoon collected in the wild state, not raised in captivity, there were 596 eggs (the largest number I have found in any single cocoon); most of these could, with certainty, be ranked as large eggs (about 478) while about 118 of the eggs were clearly small eggs, but a few were intermediate in size between these two groups. The latter case is important in showing that while intermediate sizes may occur between the large and the small eggs, in the same cocoon or in successive cocoons, the intermediates are very few in number compared with the extremes, a condition that would not occur in simple individual variation.

The conclusions permitted by these observations are as follows: This species of *Theridium* produces large eggs and small eggs; in one cocoon all may be large or all may be small, or in any one cocoon both kinds may occur; intermediates in size are relatively very infrequent. Such a difference of volume might be termed "dimegaly" for convenience, especially when no structural differences are found or known to accompany this difference in volume. But there is a possibility if not a probability that this dimegaly may be dimorphism, and that females develop from the large eggs and males from the small ones. The adult female spiders are considerably larger than the adult males, notably with regard to the dimensions of the abdomen. The occurrence of occasional intermediates between the two kinds of eggs may be readily explained by the fact that in each kind of eggs there is always some individual variation in volume, in conjunction with the assumption that the smallest extremes of the larger kind may not be larger than the largest extremes of the smaller. In those cases where some cocoons contain only large eggs, others only small ones, there would then be instances where some cocoons produce only females and others only males. Further, if this dimegaly is really dimorphism, a conclusion, that we are tentatively maintaining, then in a succession of cocoons made by the same spider there would be batches of female eggs only

alternating with batches of male eggs only; I did not have a sufficient number of cocoons from any one female to determine what is the regularity of this succession. Or again both kinds of eggs may occur in the same cocoon, and perhaps future observations will show that the first cocoons contain only large (or small) eggs, the next succeeding eggs of both kinds, and the last cocoons only small (or large) eggs.

Whether this dimegaly is true sexual dimorphism can be decided only by examining the genital organs of the hatching spiderlings since there are no external sexual differences apparent in the young, which would require much labor; or by raising all the spiderlings to maturity, a method that would require still more time and patience. But one of these methods must be tried in order to finally demonstrate whether this is true sexual dimorphism of the eggs.

If the small and large eggs of *Theridium* are really male and female eggs, and it must be admitted that there is a probability of this, then here is another instance of two kinds of eggs to be added to those already known, namely, the cases of the Aphids, Rotatoria and *Dinophilus apatris*. Adult sexual differences in size are very marked in many spiders, the male is probably always somewhat the smaller, and in many species, particularly among the Argiopidæ, Theridiidæ and Thomisidæ the disparity in size of the sexes is most striking. It would be of interest to examine this point in the case of the common orb-weaver *Argiope cophinaria* (Walck.), where the male may be less than one fiftieth the volume of the grown female, here if any where there should be marked dimorphism of the eggs; and in species of the genus *Acrosoma*. The common *Epeira labyrinthea* Hentz would be especially favorable because it places its cocoons in a string in the order of their making.